

**\*\*\* PROOF OF YOUR ARTICLE ATTACHED, PLEASE READ CAREFULLY \*\*\***

After receipt of your corrections your article will be published initially within the online version of the journal.

**PLEASE NOTE THAT THE PROMPT RETURN OF YOUR PROOF CORRECTIONS WILL ENSURE THAT THERE ARE NO UNNECESSARY DELAYS IN THE PUBLICATION OF YOUR ARTICLE**☐ **READ PROOFS CAREFULLY****ONCE PUBLISHED ONLINE OR IN PRINT IT IS NOT POSSIBLE TO MAKE ANY FURTHER CORRECTIONS TO YOUR ARTICLE**

- § This will be your only chance to correct your proof
- § Please note that the volume and page numbers shown on the proofs are for position only

☐ **ANSWER ALL QUERIES ON PROOFS** (Queries are attached as the last page of your proof.)

- § List all corrections and send back via e-mail to the production contact as detailed in the covering e-mail, or mark all corrections directly on the proofs and send the scanned copy via e-mail. Please do not send corrections by fax or post

☐ **CHECK FIGURES AND TABLES CAREFULLY**

- § Check sizes, numbering, and orientation of figures
- § All images in the PDF are downsampled (reduced to lower resolution and file size) to facilitate Internet delivery. These images will appear at higher resolution and sharpness in the printed article
- § Review figure legends to ensure that they are complete
- § Check all tables. Review layout, titles, and footnotes

☐ **COMPLETE COPYRIGHT TRANSFER AGREEMENT (CTA) if you have not already signed one**

- § Please send a scanned signed copy with your proofs by e-mail. **Your article cannot be published unless we have received the signed CTA**

☐ **OFFPRINTS**

- § 25 complimentary offprints of your article will be dispatched on publication. Please ensure that the correspondence address on your proofs is correct for dispatch of the offprints. If your delivery address has changed, please inform the production contact for the journal – details in the covering e-mail. Please allow six weeks for delivery.

**Additional reprint and journal issue purchases**

- § Should you wish to purchase a minimum of 100 copies of your article, please visit [http://www3.interscience.wiley.com/aboutus/contact\\_reprint\\_sales.html](http://www3.interscience.wiley.com/aboutus/contact_reprint_sales.html)
- § To acquire the PDF file of your article or to purchase reprints in smaller quantities, please visit <http://www3.interscience.wiley.com/aboutus/ppv-articleselect.html>. Restrictions apply to the use of reprints and PDF files – if you have a specific query, please contact [permreq@wiley.co.uk](mailto:permreq@wiley.co.uk). Corresponding authors are invited to inform their co-authors of the reprint options available
- § To purchase a copy of the issue in which your article appears, please contact [cs-journals@wiley.co.uk](mailto:cs-journals@wiley.co.uk) upon publication, quoting the article and volume/issue details
- § Please note that regardless of the form in which they are acquired, reprints should not be resold, nor further disseminated in electronic or print form, nor deployed in part or in whole in any marketing, promotional or educational contexts without authorization from Wiley. Permissions requests should be directed to [mailto:permreq@wiley.co.uk](mailto:mailto:permreq@wiley.co.uk)

## Review

# The association between emotions and eating behaviour in an obese population with binge eating disorder

Q1 W. Nicholls,<sup>1</sup> T. J. Devonport<sup>2</sup> and M. Blake<sup>2</sup>

Q2 <sup>1</sup>Institute of Psychology, University of  
Wolverhampton, Wolverhampton, UK, and  
<sup>2</sup>Institute of Sport, University of  
Wolverhampton, Wolverhampton, UK

Received 14 July 2015; revised 30 August  
2015; accepted 30 August 2015

Address for correspondence: Dr W Nicholls,  
Institute of Psychology, University of  
Wolverhampton, Nursery Street,  
Wolverhampton WV1 1AD, UK.  
E-mail: Wendy.Nicholls@wlv.ac.uk

## Summary

There is utility in understanding the antecedents of binge eating (BE), with a view to explaining poorer weight loss treatment responses in this subgroup. A systematic review was completed according to PRISMA guidelines with the aim of exploring Q3 associations between emotions and eating behaviour in a population affected by obesity and binge eating disorder (BED). A comprehensive literature search of four electronic databases (2004–2014) yielded 15 studies for inclusion. Included studies performed poorly on data quality analysis with respect to controlling for confounding variables, and sample size. Included papers largely focused on negative emotions as antecedents of BE; depression was consistently associated with a BED-obese classification and BE. Negative mood, sadness, tension and instability of emotions were found to be antecedents of BE in an adult BED-obese sample. However, findings were mixed regarding the role of stress, anger and positive emotions within the BED-obese population. Recommendations are presented for the identification of BED, and ecologically valid experimental designs that further understanding of the complex and varied emotions that associate with BE. The implications of these and other limitations for both researchers and practitioners are discussed. The paper concludes with recommendations for future research alongside suggestions for practitioners.

**Keywords:** Binge eating disorder, emotional eating, non-purging, obesity.

**Abbreviations:** BE; binge eating; BED; binge eating disorder; BMI; body mass index; DSM-IV; Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; DSM-V; Diagnostic and Statistical Manual of Mental Disorders, 5th Edition; EMA; ecological momentary assessment; s-BED; sub-threshold binge eating disorder; SD; standard deviation.

obesity reviews (2015)

## Background

Binge eating disorder (BED) is characterized by at least one episode per week of uncontrolled eating, where an objectively large quantity of food is consumed, along with a sense of loss of control, and in the absence of purging or compensatory behaviour (1). The World Mental Health Survey (2)

estimated average lifetime prevalence of BED at 1.9% across the 14 countries surveyed (e.g. France, Germany, Italy, New Zealand, Colombia and USA). The recent Diagnostic and Statistical Manual of Mental Disorders (5th Edition) (3) recognizes BED as a discrete classification as opposed to 'not otherwise specified' (4), thus reflecting a growing acknowledgement of this condition.

The association between BED and obesity is complex (5). However, there is support for the contention that, among those classified as obese, a subgroup of individuals can be identified as having BED (6). BED-obese individuals tend to have higher body mass (7,8), higher rates of mental disorders (e.g. depression, psychosis and anxiety) (9,10), higher distress (7) and poorer health outcomes (11) and quality of life (12). BED-obese individuals respond to treatment with varying patterns of success (5); there is therefore utility in understanding the antecedents of binge eating (BE), with a view to explaining the poorer outcome and treatment responses in this subgroup, and developing appropriate interventions.

Emotional antecedents are common to theories explaining the function of BE. Examples include the affect regulation model, which suggests that BE is intended to serve the function of reducing negative affect (13), and the escape awareness theory (14), which proposes bingeing as be a strategy to avoid negative emotion. Cognitive theory of eating disorders (15–17) explains BE as a temporary abandonment of restricted eating (15), which is associated with changes in mood, typically in an adverse direction among those with BED (18,19).

The concept of negative emotions as antecedents of eating has empirical support. Those with BED report BE being driven by expectations that mood will improve, rather than expectations around satisfying hunger (20), and there is evidence that BE is preceded by negative emotions (21) and stress (22) in this population. As such, it could be argued that BE is used as a form of emotion regulation and could be categorized as 'emotional eating'.

Emotional eating refers to eating in order to regulate emotion states in a desired direction (23,24). Those with BED may use eating to regulate their emotions in place of more adaptive regulatory strategies (25). The use of food to regulate emotions is associated with a failure to maintain weight management goals (26). Carter and Jansen (27) highlight that in developing interventions for obesity, it is of central importance to consider the thoughts and feelings that are antecedents of eating.

The nature of emotional eating as a drive to binge has typically been studied through exploration of a single or limited number of largely negative emotions (e.g. stress and depression). This lacks consideration of the complex and ephemeral nature of emotions (28) and, consequently, the subtle differences in eating behaviour that different types of emotion may bring about. Consideration of the interaction between discrete emotions and BE would have both clinical and theoretical utility. The purpose of this review is to systematically identify and evaluate evidence of associations between emotions and eating in a BED-obese population. This will help establish evidence of trends for discrete emotions as antecedents of BE, and corroborate, or indeed contest, existing theoretical contentions regarding the role of negative emotions in BE.

## Method

To ensure methodological rigour, objectivity and replicability, standard methodology for systematic reviewing (29–31) was applied. The review was registered on PROSPERO (CRD42014013138), and aims, inclusion criteria, data extraction and data quality evaluation were specified at the outset.

## Searches

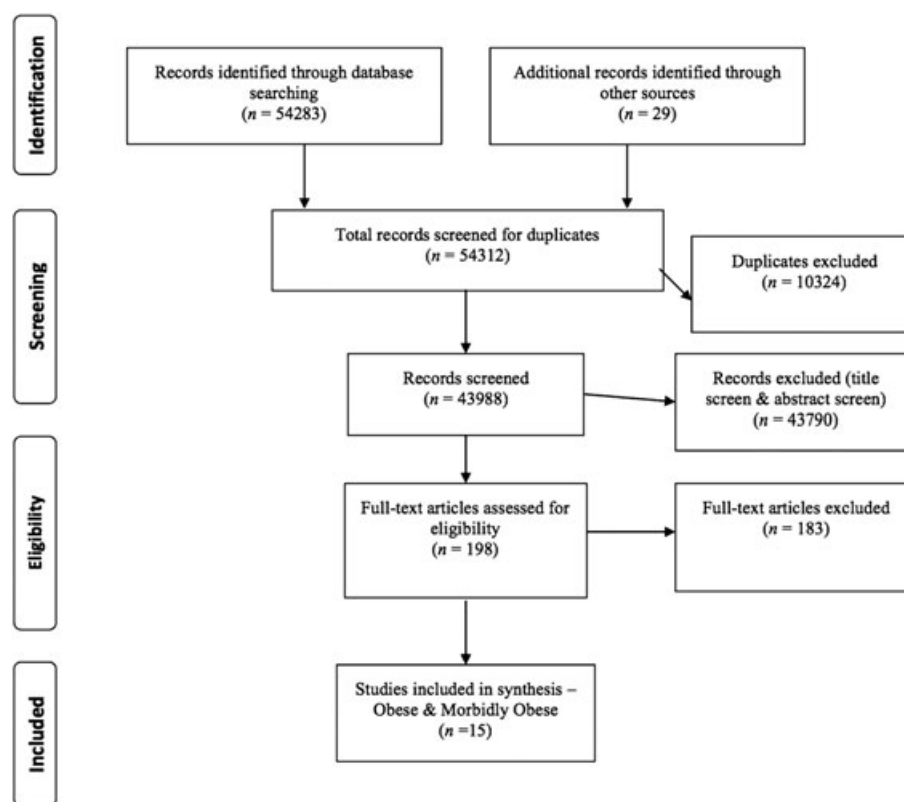
A systematic search of four electronic databases (PsychINFO, Medline, the Cumulative Index to Nursing & Allied Health Literature and SportDiscus) was undertaken. Search terms described emotions, consumption of food and regulation (see Appendix A for example search). It was of importance that the review captured a wide range of discrete emotions. Therefore, descriptors from four measures of emotion (32–35) were pooled, to compile the search terms for 'emotion'. In addition, the National Obesity Observatory knowledge update was hand-searched for relevant papers.

The search was limited to literature published over a 10-year period between July 2004 and July 2014. The rationale being that a systematic review conducted in 2004 (36), concluded there was insufficient knowledge on the nature of atypical eating disorders (including BED) to inform interventions. In addition, there has been a marked increase in severe obesity from 2004 to 2014 (37). The search was delimited to peer-reviewed articles, 'human only' studies (for Medline) and English language. No other restrictions were applied.

## Inclusion assessment

Reference management software was used to organize citations (Endnote). The search yielded 54,283 references (Fig. 1). After deduplication, 43,988 titles were independently screened by two reviewers. Where there was disagreement, the full text manuscript was consulted by two reviewers to reach agreement. For a paper to be included, there had to be consensus that the following criteria were met:

- Empirical research;
- Published in a peer-reviewed journal;
- Measured, assessed (quantitative) or discussed (qualitative) emotion or emotional eating;
- Measured, assessed (quantitative) or discussed (qualitative) eating or eating behaviour;
- Reported on participants identified as having BED (non-purging);
- Positioned emotions as a causal factor in contributing to eating behaviour (i.e. papers describing emotions occurring as a *result* of eating were excluded); and



**Figure 1** Selection of studies for inclusion in review.

(g) Reported participant's mean body mass index (BMI) to be in excess of  $30 \text{ kg m}^{-2}$ .

Following the title screen, the full text from 198 articles was assessed for eligibility. A further 183 papers were excluded at this stage. These included 112 papers without obese participants, 19 papers without participants identified as having BED, 15 without reports on the association of interest, 12 papers where participants engaged in purging behaviour, eight papers that did not report BMI (thus precluding inclusion assessment), four unpublished theses, three that were not peer-reviewed, four narrative reviews, three where data were collapsed across groups and no findings of relevance could be extracted, one case study, one with participants with anorexia nervosa and one addendum to an included paper. Following full inclusion assessment, 15 papers were included in the review.

### Data quality

Quality of included papers was assessed by the first two authors using the standard quality assessment for evaluating primary research papers (38). Studies were evaluated against 20 criteria spanning design, sampling, methodology, analysis, results and conclusions. For each criterion, papers scored either 2 (*good*), 1 (*partial fulfilment*), 0 (*not fulfilled*)

or X (*not relevant*). A mean score was calculated for each paper to give an overall rating of quality. The mean score across all papers for each criterion was calculated to indicate the relative strengths and limitations within the included studies.

### Data extraction

Data extraction parameters were established in line with the aims of the systematic review and managed in a spreadsheet using Microsoft Excel. Data extraction headings facilitated the capture of pertinent information including participants, measures, reported outcomes, research limitations and implications for practice.

## Results

### Characteristics of the included studies

All 15 included studies (Table 1) used quantitative methods. The included studies were largely of Western origin including USA ( $n=3$ ), Germany ( $n=5$ ), Australia ( $n=3$ ), Italy ( $n=1$ ), Canada ( $n=1$ ), Netherlands ( $n=1$ ) and Switzerland ( $n=1$ ). With regards to the population recruited, six studies recruited both clinical (i.e. patients accessing treatment facilities) and non-clinical samples (i.e. community), four studies

**Table 1** Characteristics of included studies

Authors	Mean data quality (SD)	Sample size (in groups where appropriate)	% Female participants in sample	Age mean (SD) or range (years)	Type of sample	BMI mean (SD)	Method of assessing BED	Sample size classified as BED n (%)	Emotion	Eating behaviour or emotional eating
Allen <i>et al.</i> (39)	1.73 (0.46)	259 (healthy weight $n = 154$ , overweight $n = 72$ , obese $n = 33$ )	51	8–13	Clinical and non-clinical	Mean z-scores: objective BE = 1.72 (0.84), subjective BE = 1.02 (1.04), objective overeating = 0.81 (0.83), non-BE = 0.66 (1.04)	Interview: Eating Disorder Examination Adapted for Children (ChEDE) (78)	Objective BE $n = 11$ (4.2%), subjective BE $n = 13$ (5%), objective overeating $n = 15$ (5.8%)	Child Depression Inventory (79)	Child Affect Regulation Scale (80)
Amianto <i>et al.</i> (55)	1.69 (0.63)	103 (BED $n = 44$ , s-BED $n = 47$ )	88.35	BED = 41 (13), s-BED = 44 (12)	Clinical	BED = 36.6 (4.9), s-BED = 38.54 (5.9)	Interview: applying DSM-IV-TR criteria (81); Self-report: Binge Eating Scale (BES), a score of 17 or over (83)	103 (100%)	Beck Depression Inventory (BDI) (82), Hypomania Checklist (83)	BES (63)
Burmeister <i>et al.</i> (44)	1.47 (0.72)	57 (obese BED)	68.4	47.4 (13.7)	Non-clinical	38.2 (8.1)	Self-report: BES [50]	57 (100%)	Center for Epidemiological Studies Depression Scale (84)	Dutch Eating Behaviour Questionnaire, emotional eating subscale (DEBQ) (85), Eating Self-Efficacy Scale (86)
Colles <i>et al.</i> (42)	1.13 (0.35)	180 (BED-obese $n = 18$ , uncontrolled eater obese $n = 40$ , grazer obese $n = 34$ , obese $n = 88$ )	80	45.2 (11.5)	Clinical	44.3 (6.8) n.b. not reported separately per group	Interview applying the DSM-IV criteria; self-report: the Questionnaire on Eating and Weight Patterns-Revised (QEWP-R) (87,88)	18 (10%)	BDI (82); a bespoke list of emotional factors that were precursors to food consumption was used	Night Eating Scale (Bespoke), grazing behaviour (bespoke and interview); Three-Factor Eating Questionnaire (TFEQ) (88)
Colles <i>et al.</i> (45)	1.08 (0.28)	431 (BED-obese $n = 38$ , comparison group $n = 38$ , non-BED obese $n = 307$ , other comparison groups $n = 130$ )	81.21	BED-obese = 42.7 (8.2), BED comparison group = 43.9 (8.5), non-BED obese = 46.1 (14)	Clinical and non-clinical	BED-obese = 42.8 (8.1), BED comparison group = 42.6 (7.6), non-BED obese = 32.5 (10.6)	Interview: semi-structured clinical face to face (70%) or phone interview (30%) applying DSM-IV criteria; self-report: the Questionnaire on Eating and Weight Patterns-Revised (QEWP-R) (89,87)	38 (8.82%)	BDI (82)	TFEQ (88)

53 (31.31%)  
 it me  
 d explicitly

(Continues)



Table 1. (Continued)

Authors	Mean data (SD)	Sample size (in groups where appropriate)	% Female participants in sample	Age mean (SD) or range (years)	Type of sample	BMI mean (SD)	Method of assessing BED	Sample size classified as BED n (%)	Emotion	Eating behaviour or emotional eating
Davis <i>et al.</i> (57)	1.50 (0.67)	164 (BED-obese n = 53, non-BED obese n = 52, control n = 59)		BED-obese = 35 (6.5), non-BED obese = 36.4 (6.5), control = 33.5 (7.5)	Non-clinical	BED-obese = 35.2 (8.9), non-BED obese = 39 (8.5), control = 22.4 (2.8)	Interview: Eating Disorder Examination (EDE) (58) and applying DSM-IV criteria			DEBQ, emotional eating subscale (85), Eating Behaviour Patterns Questionnaire (EBPQ) (90)
Dingemans <i>et al.</i> (48)	1.41 (0.62)	66 obese BED and s-BED	100	39 (9.6)	Clinical and non-clinical	Experimental group 1 = 32.6 (8.18), experimental group 2 = 33.8 (6.48)	Interview: EDE (58), and applying DSM-IV criteria	66 (100%)	BDI (82); visual analogue scale (VAS) to assess emotions on a 10 cm scale	Loss of control and perceived intake of food using VAS, Taste Test Questionnaire (91)
Goldschmidt (43)	1.69 (0.60)	46	100	10.5 (1.9)	Clinical and non-clinical	Mean z-score = 2.27 (0.40), BMI percentiles = 98.25 (2.00)	Interview: ChEDE (78)	46 (50%)	The Face Scale (adapted from Wong & Baker (92)) a VAS assessing mood via a sequence of seven emotionally valenced faces	Food intake during test meal; hunger, fullness and desire to eat was assessed using a five-point Likert-type scale; semi-structured interviews were completed to determine loss of control (adapted from (93))
Hilbert & Tuschien-Caffier (41)	1.67 (0.49)	60 (BED-obese n = 20, bulimia nervosa n = 20, control n = 20)	100	BED-obese = 36.65 (10.1), bulimia nervosa = 24.47 (5.83), control = 36.3 (9.43)	Non-clinical	BED-obese = 32.9 (6.9), bulimia nervosa = 23.13 (4.61), control = 32.18 (6.53)	Interview: applying DSM-IV criteria	20 (33%)	Ecological Momentary Assessment (EMA); using a minicomputer, mood was rated on seven-point rating scale (ranging from 0 = very bad to 6 = very good), at random intervals and before, during and after eating	Diary: type and quantity of the foods consumed; start and end of an episode; whether participant qualified an eating episode as binge eating episode and inappropriate compensatory behaviour; caloric intake during test period of 2 d
Laessle & Schultz (49)	1.54 (0.52)	48 (BED-obese n = 17, non-BED obese n = 31)	100	BED-obese = 33.6 (8.0), non-BED obese = 34.5 (8.1)	Non-clinical	BED-obese = 36.7 (5.7), non-BED obese = 37.1 (6.3)	Interview: the Structured Diagnostic Interview for DSM-IV, German version (SKID) (94)	17 (35.42%)	The Trier Social Stress Test (TSSST) (69), VAS to assess stress on a 10 cm scale	Universal Eating Monitor (UEM): this is a desk equipped with hidden electronic scale that records weight changes on the plate every 0.5 s (95) and measured eating rate, size of spoonfuls, frequency of spoonfuls and total intake
Mitchell (40)	1.58 (0.51)	2,266	78.6	18–78	Clinical		Self-report: applying DSM-IV criteria with DSM-	350 (15.7%)	BDI (82)	

(Continues)

Table 1. (Continued)

Authors	Mean data (SD)	Sample size (in groups where appropriate)	% Female participants in sample	Age mean (SD) or range (years)	Type of sample	BMI mean (SD)	Method of assessing BED	Sample size classified as BED n (%)	Emotion	Eating behaviour or emotional eating
Munsch (56)	1.58 (0.51)	22 (obese BED)	100	45.5 (12)	Clinical	Median = 45.6 (range = 41.3–51.6) 33.4 (6.8)	V cut-off of one binge per week Interview: Eating Disorder Examination (96), SKID (94)	22 (100%)	EMA using the Mood Assessment Inventory (97)	Two items measured loss of control; three items measured night eating Electronically administered question 'Did you experience a binge episode?' UEM
Schulz & Laessle (50)	1.42 (0.65)	71 (BED n = 35, non-BED n = 36)	100	BED group = 32.4 (8.0), non-BED = 35.6 (8.4)	Non-clinical	BED group = 37.0 (5.5), non-BED group = 36.9 (6.1)	Interview: SKID (94)	35 (49.3%)	TSST (69), VAS to assess stress on a 10 cm scale	
Svaldi <i>et al.</i> (51)	1.50 (0.67)	52 (BED n = 27, healthy control [HC] n = 25)	100	BED = 42.7 (11.6) HC = 38.3 (13.8)	Clinical BED and non-clinical HC	BED group = 36.7 (3.89) HC = 33.8 (6.53)	Interview: SKID (94), EDE (96)	27 (51.9%)	Sadness was rated on a Likert scale ranging from 1 (not at all) to 8 (extremely), BDI (82)	Desire to binge (bespoke)
Zeeck <i>et al.</i> (46)	1.75 (0.62)	63 (BED-obese n = 20, non-BED obese n = 23, HC n = 20)	100	BED-obese = 39.3 (12.7), non-BED obese = 45.4 (11.3), HC = 39.7 (11.6)	Clinical BED-obese and non-clinical obese; non-clinical HC	BED-obese = 42.8 (6.0), non-BED-obese = 45.4 (11.3), HC = 23.1 (2.5)	Interview: applying DSM-IV criteria	20 (32%)	Symptom Check List 27 (98)	Emotional Eating Scale (65) and Differential Affect Scale (64) combined to measure emotional eating

BE, binge eating; BED, binge eating disorder; BMI, body mass index; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; s-BED, sub-threshold binge eating disorder; SD, standard deviation.

recruited from a clinical sample and five recruited from a non-clinical sample. The number of BED participants recruited ranged from 11 (39) to 350 (40), with those participants categorized as BED having mean BMI ranging from 32.9 kg m<sup>-2</sup> (standard deviation [SD]=6.9) (41) to 44.3 kg m<sup>-2</sup> (SD=6.8) (42). Regarding the age of participants, 13 studies reported on adults and two studies reported on children (39,43); the mean age ranged from 10.5 (SD=1.9) (43) to 47.4 (SD=13.7) (44) years. The percentage of female participants in studies ranged from 51% to 100%.

## Data quality

The possible range of scores on the quality assessment was 0–2, with a higher score indicating better quality (38). The mean scores (SD) for individual indicators of quality across **T2** all included studies are presented in Table 2. The overall mean score for data quality was 1.52 (SD=0.20,  $n=15$ ; range=1.08 (45) to 1.75 (46)). Two studies scored more than one standard deviation below the sample mean (42,45) (Table 2). While the findings from these studies are included in the synthesis, they should be interpreted with caution.

Studies performed well on describing hypotheses and participants lost to follow-up. Studies performed poorly on controlling for confounding variables. For example, all but two (41,46) experimental studies, which measured food consumption, failed to account for BE being more prevalent towards the evening (47) when scheduling data collection (41,43,48–51,46). A further example was offering limited food types in experiments (43,48–51); not only is food craving culturally specific (52,53), but increasing the variety and

amount of food presented in laboratory meals increases the amount eaten (54).

Overall, the included studies were of poor quality in relation to the sample size. Despite the BED focus of included studies, only four studies had 100% classified as having BED or sub-threshold BED (s-BED) (44,55,48,56), and seven papers had less than (or equal to) one-third of participants classified with BED (39–42,45,57,46). Data reporting in analyses was not consistent enough to allow for meta-analysis, and for the most part, effect sizes and estimates of variance were not reported.

## Measurement

Emotion as an antecedent of eating was typically assessed using validated psychometric scales (39,40,42,44,55,45,48,56,51,46). Depression was most commonly examined (Table 1). Visual analogue scales were used to measure emotions in four studies (43,48–50), and three used a bespoke scale (41,42,51). Emotional eating was assessed using two validated psychometric measures across three of the included studies (44,57,46).

A wide range of measures were utilized to assess BED (Table 1), which presents challenges in drawing comparisons across the published literature. In eight studies, a trained practitioner administered a structured clinical interview, including the structured clinical interview for the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) (49,56,50,51), the Eating Disorders Examination (57,48,56,51) and the Child Eating Disorder Examination (39,43) (adapted from the adult version (58)). Eight of the included studies assessed presentation of BE against DSM-IV criteria using either a bespoke interview (40–42,55,45,57,48,46) or self-report data (40). All included studies assessed BE retrospectively, presenting a limitation, as some individuals who explicitly deny BE when assessed retrospectively, demonstrate behaviours that meet BED criteria when assessed in the moment (59,60).

## Application of DSM BED diagnostic criteria in included studies

Twelve of the included studies classified participants according to DSM-IV (4) diagnostic criteria. The variability in classification of BED may be accounted for by a recent change in frequency of BE episodes required for diagnosis of BED (61) (from twice weekly (4) to once (3)). Two studies cited a cut-off of two binge episodes per week (42,45); two studies used a cut-off of one BE episode per week (40,57). Four studies stated that the DSM-IV (4) criteria had been applied, implying that a cut-off of two binge episodes per week was used (41,56,51,46). As a further complexity in the classification of BED, four studies classified participants with a sub-threshold variant of BED (s-BED). This is defined

**Table 2** Indicators of quality for included studies

Item	Indicator of quality	Mean	(SD)
1	Hypothesis description	1.87	(0.35)
7	Describing those lost to follow-up	1.80	(0.45)
3	Predictor and outcome measures description	1.67	(0.49)
14	Methods of analysis	1.67	(0.49)
2	Study is well described	1.67	(0.49)
20	Conclusions	1.61	(0.51)
6	Describing the sample	1.60	(0.51)
5	Selection is unbiased	1.60	(0.51)
19	Description of findings	1.60	(0.51)
13	Quality of measures	1.53	(0.52)
4	Follow-up	1.5	(0.58)
9	Randomisation	1.50	(0.58)
15	Inclusion of effect sizes	1.33	(0.72)
10	Description of protocol	1.33	(0.82)
8	Sample size	1.27	(0.70)
16	Control for confounding variables	1.13	(0.64)

**Q10** None of the included studies were RCTs, therefore the four items referring to RCTs are excluded from the reported data.  
SD, standard deviation.



as having a minimum of one binge episode per week (62), while fulfilling all other DSM-IV criteria (4). One study analysed the s-BED group separately (55), and three merged them with the BED group (48–50).

Finally, BED was not classified according to the DSM (3,4) criteria in three of the included studies, which used the Binge Eating Scale (44) or the Child Eating Disorder Examination (39,43). Goldschmidt *et al.* (43) reported frequency of bingeing episodes; participants classified as BED reported a mean of 12 (SD = 13.5) BE episodes over the past 3 months, placing them within the range of one episode per week in line with Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (3). There is a need for researchers to consistently apply diagnostic criteria to improve the clinical utility of research findings.

## Narrative synthesis of findings and discussion

### Associations between emotions and binge eating

In a community sample of obese individuals with BED (44), depression was both positively and significantly correlated with self-reported BE as measured by a psychometric tool, the Binge Eating Scale (63). Higher depressive symptoms were also independently related to higher odds of reporting with BED (40). Finally, meeting diagnostic criteria for BED-obese was associated with receiving treatment for depression (40) when compared with non-BED-obese and normal weight controls.

Zeeck *et al.* (46) invited participants to recall their last experience of a particular emotion during a one-to-one standardized interview. They then rated 'urge to eat'. A list of emotions, provided as a prompt, was taken from the Differential Affect Scale (64) and the Emotional Eating Scale (65). An urge to eat was significantly higher in BED-obese patients experiencing anger or feelings of being hurt, guilty or disappointed, in comparison with non-BED-obese and healthy controls. There was also a statistical difference concerning the positive emotion 'satisfied', with BED-obese showing the lowest urge to eat when experiencing this emotion (46).

Allen *et al.* interviewed children (aged 8–13 years) to establish the presence or absence of BE in the month prior to assessment. Clinician assessed children's BE during interviews at baseline and 1-year follow-up. Emotions were associated with onset and cessation of BE. Specifically, ceasing BE was associated with a decrease in depression and emotional eating. The onset of BE was associated with a slight increase in these variables or they remained stable over time (39).

Finally, BE (as measured by the Binge Eating Scale (63)) was significantly correlated with hypomania (55). The authors conclude that 'affective instability, which characterizes bipolar spectrum disorders, might be a particularly potent

predictor of BE' (p. 582). Further evidence of the importance of the stability of emotions was found in experimental research (see succeeding text (56)).

There are limitations to measuring the association between emotions and BE using self-report as the previous studies have done. These include under-reporting (59,60) and reliance on the participant's accurate recall of events/emotions. In an attempt to overcome the limitations of retrospective recall, other studies (41,56) attempted to capture BE as it occurs, within the natural environment.

### Ecological momentary assessment

Munsch *et al.* (56) used ecological momentary assessment (EMA) to explore emotions and BE. Participants were supplied with a palmtop computer, which was used to ask direct questions about eating and emotions (e.g. Did you experience binge eating since your last entry?) or to respond to a computerized Likert or visual analogue scale.

Participants completed the questionnaires in response to an alarm that was set at five time-contingent intervals throughout the day, over 7 d. In addition, event-contingent data were gathered whereby participants completed the questionnaires whenever BE occurred. Using this method allows for subtle variations in emotion to be mapped against BE episodes. With a sample of BED-obese participants, immediately before a BE episode, a significant curvilinear increase in tension was observed, coupled with a significant curvilinear decrease in positive mood; this was most pronounced shortly before the first binge (56). There was a slight improvement in mood up until 30 min before a binge episode, followed by an abrupt deterioration immediately before the binge. Together with findings relating BE to hypomania (55), this suggests that the stability of, and interplay between, emotions may be of interest in examining antecedents of BE.

Using a similar protocol, Hilbert (41) asked participants to rate their mood (on a seven-point rating scale where 0 = *very bad* and 6 = *very good*) on 32 randomized occasions per day, over 2 d, and before, during and after each episode of eating. Mood was significantly more negative prior to BE episodes, when compared with normal eating episodes among participants diagnosed with BED; this pattern did not occur in healthy controls. However, as the paper examines the role of general negative mood in BE episodes, it offers no insight into the role of discrete emotions.

With regards to the protocol used to capture emotions and BE behaviour, an EMA protocol, as exemplified here (41,56), offers several advantages. Given that EMA occurs in the natural environment, this increases ecological validity by allowing for more naturalistic observations of eating behaviour, and other variables of interest (66). Furthermore, the use of this methodology offers greater insight into the trajectory of emotions over time, the associations between

emotions and their significance for binge behaviours. This presents the potential to determine if relationships between emotions and food are systematically associated over time.

It is important to note that EMA methods may not be without limitations. Assessments are completed repeatedly and in close proximity to the behaviours, thoughts and emotions of interest. As such, this presents the possibility that the research methods themselves may affect the variables under investigation (66,67); this is known as reactivity. In completing an assessment, a participant may become more aware of rising anxiety or have an opportunity to reconsider their behaviour (67) and thus take steps to lessen this emotion, or change the behaviour, should it be perceived as unwanted. For example, an individual may resolve not to binge-eat as they consciously think through the potential consequences of a binge episode.

To account for this possibility, Munsch *et al.* (56) measured reactivity to EMA using items such as 'Did the frequency of binge eating change during the diary period?' and 'Did you focus more on your psychological well-being?' They found patients to be highly compliant with no evident reactivity to EMA. Furthermore, estimated treatment effects for BE were found to be comparable for EMA and questionnaire-based methods, suggesting that BE can be equally accurately assessed by these methods (68).

### Emotional induction experiments

Five studies presented experimental data on eating behaviour in response to emotion induction. Two (49,50) tested the effect of lab-based stress induction on the consumption of chocolate pudding. The studies compared BED-obese with non-BED-obese participants who were drawn from a community sample. Stress was induced through the Trier Social Stress Test (69). Overall and independent of the stress induction, those with BED ate larger-sized spoonfuls during the laboratory 'meal' (50). Those with BED had a greater increase in average eating rate during the stress condition when compared with a no-stress condition and a corresponding greater increase in frequency of spoonfuls of chocolate pudding were eaten (49). In participants with BED, stress was associated with an increase in the initial eating rate, and they decelerated to a lesser extent than matched controls towards the end of the 'meal' (50).

Three studies induced sadness in a laboratory setting using film clips (43,48,51). In a sample of women with sub-threshold BED drawn from an eating disorders unit and the community, depressive mood at baseline was significantly associated with caloric intake during a taste test (48). There was also a significant interaction effect whereby the more depressed participants were at baseline, and the greater the sadness following the clip, then the more calories were consumed in the taste test (48).

Svaldi *et al.* explored the causal role of emotional regulation in the association between emotion and BE. After inducing sadness, participants were asked either to regulate their emotions, either by suppressing the sad emotion or reappraising it. The induction of sadness using a film clip was found to increase desire to binge among female BED patients but not among healthy controls (51). Emotion suppression mediated the association between sadness and desire to binge. Specifically, desire to binge increased from baseline to post-film in BED-obese when asked to suppress their emotion, but not after the reappraise instruction. These specific differences were not observed in the healthy controls (51). Conversely, in girls (43), total energy intake among BED participants was no different when sadness was induced when compared with a neutral condition. In the neutral film condition, those classified as 'binge eaters' ate significantly more than the control group. However, these results did not meet significance in further analyses, which found the consumption of food was not predicted by BE status, nor by the interaction between BE status and condition. It may be that the association between emotions and BE behaviour differs across the lifespan, and emotions, other than sadness, are more salient as triggers for children.

### Quasi-experimental studies

Quasi-experimental designs have explored how the association between BE and emotions differs when comparing BED-obese with a control group. Those classified as BED-obese report significantly more emotional eating (57) when compared with non-BED-obese and normal weight controls. BED-obese participants (45) report higher emotional distress related to feelings of loss of control over eating in comparison with matched non-BED-obese controls.

Colles *et al.* asked BED-obese and non-BED patients enrolled on a bariatric surgery programme what emotional factors predisposed them to consume food they knew not to be best for them. There was a significant difference in fatigue as a trigger for eating between the groups (42); however, the direction of this difference was not reported. They found no significant difference between groups in boredom or anger as an emotional trigger of eating. In contrast to experimental findings reported in the previous text, there was no difference in the frequency of stress as the self-reported trigger for eating when comparing BED-obese and non-BED-obese participants (42).

### Conclusions

Findings from included studies evidence associations between emotions and BE. Meeting the diagnostic criteria for BED-obese is associated with reporting significantly more emotional eating (57) and reported emotional eating

fluctuated in line with expectations relative to the onset and decline of BE (39).

Depression was consistently associated with BE (44,46), with BED-obese patients more likely to present with depression or have been treated for it in the past (40). Depression predicted eating behaviour among BED-obese participants during experimental taste-tests (48), and was found to be higher prior to onset of BED, thereafter decreasing when BED ceased (39).

While general negative mood was found to be an antecedent of BE among BED-obese adults (41), findings regarding associations between other discrete negative emotions and BE were less consistent. When compared with healthy controls, individuals classified as BED-obese reported no difference in stress as a trigger of BE (42); however, experimental induction of stress resulted in them eating larger spoonfuls of food (50), and at a faster rate (49). Similarly, compared with non-BED-obese, and healthy controls, BED-obese patients reported a significantly higher urge to eat when experiencing anger (46); however, there was no difference between comparable groups recalling anger as a trigger for a previous binge episode (42).

The experimental induction of sadness (43,48,51) led to consumption of more food (48) or a higher reported desire to binge (51). However, this finding was not consistent in children (43). Other negative emotions associated with an urge to eat in BED-obese patients including feeling hurt, guilty or disappointed (46), whereas boredom did not associate with BE among BED-obese (42).

Only two studies (56,46) examined positive emotions in relation to BE, with inconclusive findings. Those who were BED-obese reported the lowest intensity of desire to eat in response feeling satisfied when compared with matched obese non-BED and healthy controls (46). However, EMA data indicated that a decrease in positive emotions and an increase in tension were predictive of BE (56). Associations with hypomania (55) suggest that emotional instability may have a role in emotion and BE relationships.

## Recommendations

Theories that seek to explain the association between emotions and BE contend that individuals may be using BE to regulate emotions, specifically negative emotions (13,14,17). With this theoretical steer, knowledge regarding associations between positive emotions and BE is limited, as research has largely focussed on examination of negative emotions (70). Capturing the true intensity and complexity of emotions requires differentiation between discrete positive and negative emotions (71). As such, consideration of distinct positive and negative emotions may offer theoretical advancements and greater utility in the design and delivery of clinical interventions for BED.

Real-time self-monitoring of thoughts, feelings and behaviours has long been used in clinical practice to either assess emotions and BE or present an intervention. Self-monitoring forms are a central aspect of CBT-E (16), the aim being to increase self-awareness. However, this intervention is problematic as adherence can be poor due to the inconvenience of recording in real time (16), and it is common for BE and/or emotions to be denied or under-reported (41,72–74). Evidence supports the use of EMA as a suitable alternative on both counts (41,59,68).

Clinical use of EMA may inform interventions for alternative emotion regulation strategies (51) and targeting a reduction of BE (43). Such interventions may address eating behaviour after emotional events (e.g. awareness-based interventions or interventions that focus on cognitive restructuring) and the capacity to cope with stressful situations. Presently, evidence for the effectiveness of EMA as an intervention is equivocal, but limited (75,76). The clinical utility of research findings regarding emotions and BE could be enhanced through the aligned use of EMA in clinical and research practices. This would help identify relatively consistent associations in the temporal dynamics of discrete antecedent, concomitant and consequent emotions and cognitions in relation to food intake.

A final practical implication from this review stems from the consistent findings that BE was under-reported in included studies. Establishing trust and honesty in therapeutic relationships is a prerequisite for developing understanding and supporting behaviour change interventions (77). These attributes facilitate the expression of emotions-related and behaviours-related eating (77), which is vitally important in addressing under-reporting. Clinicians must emphasize the need for mutual trust and honesty in supporting a therapeutic alliance, reinforcing this need when undertaking diagnostic interview or utilizing patient self-monitoring.

In conclusion, the included studies offered support for the association between emotions and BE. However, theories that seek to explain emotions and BE associations largely discount the possible role of positive emotions. In order to progress theory and clinical practice, researcher and clinicians must address methodological limitations outlined within the present paper and consider the role of discrete positive and negative emotions prior, during and post BE behaviours.

## Acknowledgements

We would like to acknowledge the assistance of Sharon Stevens, for helping to define the search terms for this study.

## Conflict of interest statement

There are no conflicts of interest to declare.



## References

1. Wolfe BE, Baker CW, Smith AT, Kelly Weeder S. Validity and utility of the current definition of binge eating. *Int J Eat Disord* 2009; **428**: 674–686.
2. Kessler RC, Berglund PA, Chiu WT *et al.* The prevalence and correlates of binge eating disorder in the World Health Organization World Mental Health Surveys. *Biol Psychiatry* 2013; **739**: 904–914.
3. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders: DSM-V*. American Psychiatric Association: Washington DC, 2013.
4. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV*. American Psychiatric Association: Washington DC, 1994.
5. Wonderlich SA, Gordon KH, Mitchell JE, Crosby RD, Engel SG. The validity and clinical utility of binge eating disorder. *Int J Eat Disord* 2009; **428**: 687–705.
6. Mitchell JE, Crosby RD *et al.* Latent profile analysis of a cohort of patients with eating disorders not otherwise specified. *Int J Eat Disord* 2007; **40**: S95–S98.
7. Kolotkin RL, Westman EC, Ostby T, Crosby RD, Eisenson HJ, Binks M. Does binge eating disorder impact weight-related quality of life? *Obes Res* 2004; **12**: 999–1005.
8. Pike KM, Dohm FA, Striegel-Moore RH, Wilfley DE, Fairburn CG. A comparison of Black and White women with binge eating disorder. *Am J Psychiatry* 2001; **158**: 1455–1460.
9. Wilfley DE, Friedman MA, Douchis JZ, Stein RI, Welch RI, Ball SA. Comorbid psychopathology in binge eating disorder: relation to eating disorder severity at baseline and following treatment. *J Consult Clin Psychol* 2000; **68**: 641–649.
10. Telch CF, Stice E. Psychiatric comorbidity in women with binge eating disorder: prevalence rates from a non-treatment-seeking sample. *J Consult Clin Psychol* 1998; **66**: 768–776.
11. Bulik CM, Sullivan PF, Kendler KS. Medical and psychiatric morbidity in obese women with and without binge eating. *Int J Eat Disord* 2002; **32**: 72–78.
12. Perez M, Warren CS. The relationship between quality of life binge eating disorder and obesity status in an ethnically diverse sample. *Obesity* 2012; **204**: 879–885.
13. Womble LG, Williamson DA, Martin CK. Psychosocial variables associated with binge eating in obese males and females. *Int J Eat Disord* 2001; **30**: 217–221.
14. Heatherton TF, Baumeister RF. Binge eating as escape from self-awareness. *Psychol Bull* 1991; **110**: 86.
15. Fairburn CG, Cooper Z, Shafran R. Cognitive behaviour therapy for eating disorders: a “transdiagnostic” theory and treatment. *Behav Res Ther* 2003; **41**: 509–528.
16. Fairburn CG. *Cognitive Behavior Therapy and Eating Disorders*. Guilford Press: New York, 2008.
17. Cooper MJ. Cognitive theory in anorexia nervosa and bulimia nervosa: progress development and future directions. *Clin Psychol Rev* 2005; **25**: 511–531.
18. Fairburn CG, Cooper Z, Cooper PJ. (1986). The clinical features and maintenance of bulimia nervosa. In: Brownell KD, Foreyt JP (eds.). *Handbook of Eating Disorders: Physiology, Psychology and Treatment of Obesity, Anorexia and Bulimia*. Basic Books: New York, 1986: 389–404.
19. Eldredge KL, Agras WS. Weight and shape overconcern and emotional eating in binge eating disorder. *Int J Eat Disord* 1996; **19**: 73–82.
20. Stein RI, Kenardy J, Wiseman CV, Douchis JZ, Arnow BA, Wilfley DE. What’s driving the binge in binge eating disorder? a prospective study examination of precursors and consequences. *Int J Eat Disord* 2007; **40**: 195–203.
21. Telch CF, Agras WS. Do emotional states influence binge eating in the obese? *Int J Eat Disord* 1996; **20**: 271–279.
22. Gluck ME, Geliebter A, Hung J, Yahav E. Cortisol hunger and desire to binge eat following a cold stress test in obese women with binge eating disorder. *Psychosom Med* 2004; **666**: 876–881.
23. Christensen L. Effects of eating behavior on mood: a review of the literature. *Int J Eat Disord* 1993; **14**: 171–183.
24. Macht M. How emotions affect eating: a five-way model. *Appetite* 2008; **50**: 1–11.
25. Geliebter A, Aversa A. Emotional eating in overweight normal weight and underweight individuals. *Eat Behav* 2003; **34**: 341–347.
26. Elfhag K, Rössner S. Who succeeds in maintaining weight loss? a conceptual review of factors associated with weight loss maintenance and weight regain. *Obes Rev* 2005; **61**: 67–85.
27. Carter FA, Jansen A. Improving psychological treatment for obesity: which eating behaviours should we target? *Appetite* 2012; **583**: 1063–1069.
28. Lane AM, Terry PC. The nature of mood: development of a conceptual model with a focus on depression. *J Appl Sport Psychol* 2000; **12**: 16–33.
29. Higgins J, Green S. *Cochrane Handbook for Systematic Reviews of Interventions*. Wiley & Sons Ltd: Oxford, UK, 2009.
30. Khan K, ter Riet G, Glanville J, Sowden A, Kleijnen J.  *Undertaking Systematic Reviews of Research on Effectiveness: CRDs Guidance for Those Carrying Out or Commissioning Reviews*, 2nd edn Report Number 4. Centre for Reviews and Dissemination: York, UK, 2001.
31. Petticrew M, Roberts H. *Systematic Reviews in the Social Sciences: A Practical Guide*. Oxford, UK: Wiley-Blackwell Ltd, 2005.
32. Crawford JR, Henry JD. The Positive and Negative Affect Schedule (PANAS): construct validity measurement properties and normative data in a large non clinical sample. *Brit J Clin Psychol* 2004; **433**: 245–265.
33. Hanin YL. *Emotions in Sport*. Human Kinetics: Champaign, IL, US, 2000.
34. McNair PM, Lorr M, Droppleman LF. *POMS Manual*. Educational and Industrial Testing Service: San Diego, 1981.
35. Terry PC, Lane AM, Fogarty GJ. Construct validity of the POMS-A for use with adults. *Psychol Sport Exerc* 2003; **4**: 125–139.
36. National Institute for Clinical Excellence. Eating disorders: core interventions in the treatment and management of anorexia nervosa bulimia nervosa and related eating disorders. Available at <http://www.nice.org.uk/CG9> 2004. Accessed 15 May 2015.
37. Public health England. <http://www.noo.org.uk/gsf.php5?f=14605&21198>. Accessed 3rd June, 2015.
38. Kmet LM, Lee RC, Cook LS. *Standard Quality Assessment Criteria for Evaluation Primary Research Papers from a Variety of Fields*. HTA Initiative #13. Alberta Heritage Foundation for Medical Research: Alberta, Canada, 2004.
39. Allen KL, Byrne SM, La Puma M, McLean N, Davis EA. The onset and course of binge eating in 8- to 13-year-old healthy weight overweight and obese children. *Eat Behav* 2008; **940**: 438–446.
40. Mitchell JE, King WC, Courcoulas A *et al.* Eating behavior and eating disorders in adults before bariatric surgery. *Int J Eat Disord* 2014; **48**: 215–222.
41. Hilbert A, Tuschen-Caffier B. Maintenance of binge eating through negative mood: a naturalistic comparison of binge eating disorder and bulimia nervosa. *Int J Eat Disord* 2007; **406**: 521–530.
42. Colles SL, Dixon JB, O’Brien PE. Grazing and loss of control related to eating: two high risk factors following bariatric surgery. *Obesity* 2008; **163**: 615–622.
43. Goldschmidt AB, Tanofsky-Kraff M, Wilfley DE. A laboratory-based study of mood and binge eating behavior in overweight children. *Eat Behav* 2011; **121**: 37–43.

44. Burmeister JM, Hinman N, Koball A, Hoffmann DA, Carels RA. Food addiction in adults seeking weight loss treatment. Implications for psychosocial health and weight loss. *Appetite* 2013; **60**: 103–110.
45. Colles SL, Dixon JB, O'Brien PE. Loss of control is central to psychological disturbance associated with binge eating disorder. *Obesity* 2008; **163**: 608–614.
46. Zeeck A, Stelzer N, Linster HW, Joos A, Hartmann A. Emotion and eating in binge eating disorder and obesity. *Eur Eat Disord Rev* 2011; **195**: 426–437.
47. Smyth JM, Wonderlich SA, Heron KE *et al.* Daily and momentary mood and stress are associated with binge eating and vomiting in bulimia nervosa patients in the natural environment. *J Consult Clin Psychol* 2007; **75**: 629–638.
48. Dingemans AE, Martijn C, Jansen A, van Furth EF. The effect of suppressing negative emotions on eating behavior in binge eating disorder. *Appetite* 2009; **521**: 51–57.
49. Laessle RG, Schulz S. Stress induced laboratory eating behavior in obese women with binge eating disorder. *Int J Eat Disord* 2009; **426**: 505–510.
50. Schulz S, Laessle RG. Stress-induced laboratory eating behavior in obese women with binge eating disorder. *Appetite* 2012; **582**: 457–461.
51. Svaldi J, Caffier D, Tuschen-Caffier B. Emotion suppression but not reappraisal increases desire to binge in women with binge eating disorder. *Psychother Psychosom* 2010; **793**: 188–190.
52. Nicholls W, Hulbert-Williams L. British English translation of the Food Craving Inventory FCI-UK. *Appetite* 2013; **67**: 37–43.
53. White M, Grilo C. Psychometric properties of the Food Craving Inventory among obese patients with binge eating disorder. *Eat Behav* 2005; **63**: 239–245.
54. Wansink B. Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annu Rev Nutr* 2004; **24**: 455–479.
55. Amianto F, Lavagnino L, Leombruni P, Gastaldi F, Daga GA, Fassino S. Hypomania across the binge eating spectrum: a study on hypomanic symptoms in full criteria and sub-threshold binge eating subjects. *J Affect Disord* 2011; **1333**: 580–583.
56. Munsch S, Meyer AH, Quartier V, Wilhelm FH. Binge eating in binge eating disorder: a breakdown of emotion regulatory process? *Psychiatry Res* 1953; **2012**: 118–124.
57. Davis C, Levitan RD, Carter J *et al.* Personality and eating behaviors: a case-control study of binge eating disorder. *Int J Eat Disord* 2008; **413**: 243–250.
58. Fairburn CG, Cooper Z. The Eating Disorder Examination. In Fairburn CG, Wilson GT, Schleimer K (eds.). *Binge Eating: Nature Assessment and Treatment* (12th ed). Guildford Press: New York, 1993, 317–360.
59. Greeno CG, Wing RR, Shiffman S. Binge antecedents in obese women with and without binge eating disorder. *J Consult Clin Psychol* 2000; **68**: 95–102.
60. Le Grange D, Gorin A, Catley D, Stone AA. Does momentary assessment detect binge eating in overweight women that is denied at interview? *Eur Eat Disord Rev* 2001; **95**: 309–324.
61. Wilfley DE, Bishop ME, Wilson GT, Agras WS. Classification of eating disorders: toward DSM-V. *Int J Eat Disord* 2007; **40**: 123–129.
62. Striegel Moore RH, Dohm FA, Solomon EE, Fairburn CG, Pike KM, Wilfley DE. Subthreshold binge eating disorder. *Int J Eat Disord* 2000; **273**: 270–278.
63. Gormally J, Black S, Daston S, Rardin D. The assessment of binge eating severity among obese persons. *Addict Behav* 1982; **7**: 47–55.
64. Merten J, Krause R. Die differentielle Affektskala. Saarbrücken. DAS (Differentielle Affekt Skala). Univ. Fachbereich Sozial und Umweltwiss, Fachrichtung Psychologie, 1993.
65. Arnow B, Kenardy J, Agras WS. The Emotional Eating Scale: the development of a measure to assess coping with negative affect by eating. *Int J Eat Disord* 1996; **18**: 79–90.
66. Shiffman S, Stone AA, Hufford MR. Ecological momentary assessment. *Annu Rev Clin Psychol* 2008; **4**: 31–32.
67. Shiffman S. Ecological momentary assessment (EMA) in studies of substance use. *Psychol Assess* 2009; **21**: 486. Q6
68. Munsch S, Meyer AH, Milenkovic N, Schlup B, Margraf J, Wilhelm FH. Ecological momentary assessment to evaluate cognitive-behavioral treatment for binge eating disorder. *Int J Eat Disord* 2009; **42**: 648–657.
69. Kirschbaum C, Pirke KM, Hellhammer DH. The 'Trier Social Stress Test': a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology* 1993; **28**: 76–81.
70. Tchanturia K, Dapelo MA, Harrison A, Hambrook D. Why study positive emotions in the context of eating disorders? *Curr Psychiatry Rep* 2015; **171**: 1–12.
71. Fiske ST, Taylor SE. *Social Cognition*, 2nd edn. McGraw-Hill: New York, 1991.
72. Saunders R. "Grazing": a high-risk behavior. *Obes Surg* 2004; **14**: 98–102.
73. Chipperfield JG, Perry RP, Weiner B. Discrete emotions in later life. *J Gerontol B Psychol Sci Soc Sci* 2003; **58**: 23–34.
74. Faghri PD, Mignano C, Huedo-Medina TB, Cherniack M. Psychological health and overweight and obesity among high stressed work environments. *Obesity* 2015; **1**: 1. doi: 10.16966/ ooa.101. Q7
75. le Grange D, Gorin A, Dymek M, Stone A. Does ecological momentary assessment improve cognitive behavioural therapy for binge eating disorder? a pilot study. *Eur Eat Disord Rev* 2002; **10**: 316–328.
76. Shapiro JR, Bauer S, Andrews E *et al.* Mobile therapy: use of text-messaging in the treatment of bulimia nervosa. *Int J Eat Disord* 2010; **43**: 513–519. DOI: 10.1002/eat.20744.
77. Wright KM. Therapeutic relationship: developing a new understanding for nurses and care workers within an eating disorder unit. *Int J Ment Health Nurs* 2010; **19**: 154–161.
78. Bryant-Waugh RJ, Cooper PJ, Taylor CL, Lask BD. The use of the Eating Disorder Examination with children: a pilot study. *Int J of Eat Disord* 1996; **19**: 391–397.
79. Kovacs M. *Children's Depression Inventory: Manual*. Multi-Health Systems, 1992. Q8
80. La Puma M, Byrne SM. *The Child Affect Regulation Scale (CARES)*. Unpublished manuscript, 2004. Q9
81. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders. Text Revision*. American Psychiatric Association: Washington, DC, 2000, pp. 1–943.
82. Beck AT, Steer RA, Brown GK. *Manual for the Beck Depression Inventory Second Edition (BDI-II)*. Psychological Corporation: San Antonio, 1996.
83. Angst J, Adolfsson R, Benazzi F *et al.* The HCL-32: towards a self-assessment tool for hypomanic symptoms in outpatients. *J Affect Disord* 2005; **88**: 217–233.
84. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Meas* 1977; **1**: 385–401.
85. Van Strien T, Frijters JE, Bergers G, Defares PB. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *Int J Eat Disord* 1986; **5**: 295–315.



86. Glynn SM, Ruderman AJ. The development and validation of an eating self-efficacy scale. *Cognitive Ther Res* 1986; 10: 403–420.
87. Spitzer RL, Yanovski S, Wadden T *et al.* Binge eating disorder: its further validation in a multisite study. *Int J Eat Disord* 1993; 13: 137–153.
88. Stunkard AJ, Messick S. The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *J Psychosom Res* 1985; 29: 71–83.
89. Spitzer RL, Devin M, Walsh BT *et al.* Binge eating disorder: a multisite field trial of the diagnostic criteria. *Int J Eat Disord* 1992; 11: 191–203.
90. Schlundt DG, Hargreaves MK, Buchowski MS. The eating behavior patterns questionnaire predicts dietary fat intake in African American women. *J Am Diet Assoc* 2003; 103: 338–345.
91. Guerrieri R, Nederkoorn C, Stankiewicz K *et al.* The influence of trait and induced state impulsivity on food intake in normal-weight healthy women. *Appetite* 2007; 49: 66–73.
92. Wong DL, Baker CM. Pain in children: comparison of assessment scales. *Pediatr Nurs* 1988; 14: 9–17.
93. Fisher JO, Birch LL. Parents' restrictive feeding practices are associated with young girls' negative self-evaluation of eating. *J Am Diet Assoc* 2000; 100: 1341–1346.
94. Wittchen HU, Wunderlich U, Gruschwitz S, Zaudig M. SKID I. Strukturiertes Klinisches Interview für DSM-IV. Achse I: Psychische Störungen. Interviewheft und Beurteilungsheft. Eine deutschsprachige, erweiterte Bearb. d. Amerikanischen Original version des SKID I, 1997.
95. Kissileff HR, Klingsberg G, Van Itallie TB. Universal eating monitor for continuous recording of solid or liquid consumption in man. *Am J Physiol Regul Integr Comp Physiol* 1980; 238: 14–22.
96. Hilbert A, Tuschen-Caffier B, Ohms M. Eating Disorders Examination: A German version of the Structured Eating Disorder Interviews Eating Disorder Examination: Deutschsprachige Version des strukturierten Essstörungsinterviews. *Diagnostica* 2004; 50: 98–106.
97. Feist A, Stephan E. *Verfahren zur Erfassung des Gefühlszustandes (Mood Assessment Scale; in German)*. University of Cologne: Cologne, Germany, 2004.
98. Hardt J, Egle UT, Kappis B, Hessel A, Brähler E. Die Symptom-Checkliste SCL-27. Ergebnisse einer deutschen Repräsentativbefragung. *Psychother Psych Med* 2004; 54: 214–223.

## Appendix 1: Example Search Strategy (Medline)

1. Control OR restrain\*
2. Manage OR management
3. Regulation OR regulate OR regulatory
4. 1 OR 2 OR 3
5. Eat OR eating OR food OR meal\* OR snack OR snack\* OR feed OR feeding OR diet\*
6. Afraid OR fearful OR fear OR scared

7. Aggressive OR aggression
8. Active OR energetic OR alert OR exhilarated OR lively OR vigorous
9. Anger OR angry OR annoy\* OR furious OR mad
10. Anxious\* OR nervous\* OR concerned OR panicky OR apprehensive OR tense OR worried OR worry
11. Ashamed OR shame\* OR embarrass\* OR guilt\*
12. Bitter OR bitterness
13. Boredom OR bored
14. Calm OR peaceful OR relaxed
15. Cheerful OR happy OR happiness OR joyful OR overjoy\*
16. Confident OR brave OR daring OR strong
17. Confused OR mixed-up OR muddled OR uncertain
18. Content\* OR pleased OR settled
19. Dejected OR depressed OR downhearted OR miserable OR sad OR sadness
20. Disappointed OR disappointment OR disappoint OR dissatisfaction OR dissatisfied
21. Upset OR unhappy OR unhappiness
22. Delight OR delightful OR elated OR ecstatic OR excite OR excitement
23. Determine OR determined OR motivate OR motivated
24. Distress OR distressed OR pressured OR strained OR stress OR stressful OR stressed OR overwhelm OR overwhelming OR overwhelmed
25. Exhaust or exhausted OR fatigue OR sleepy OR sluggish
26. Frustrate OR frustrated OR frustration OR irritable OR irritability OR irate OR irritated OR restless OR restlessness OR uneasy OR uneasiness OR unease
27. Fulfil OR fulfilment OR satisfied OR satisfy OR satisfaction
28. Inspired
29. Proud
30. Relief
31. 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24 OR 25 OR 26 OR 27 OR 28 OR 29 OR 30
32. 4 AND 5 AND 31

# Author Query Form

**Journal: Obesity Reviews**









**Article: obr\_12329**

Dear Author,

During the copyediting of your paper, the following queries arose. Please respond to these by annotating your proofs with the necessary changes/additions.

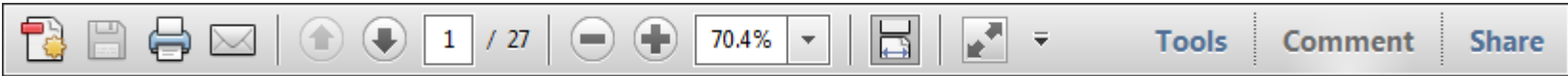
- If you intend to annotate your proof electronically, please refer to the E-annotation guidelines.
- If you intend to annotate your proof by means of hard-copy mark-up, please use the standard proofing marks. If manually writing corrections on your proof and returning it by fax, do not write too close to the edge of the paper. Please remember that illegible mark-ups may delay publication.

Whether you opt for hard-copy or electronic annotation of your proofs, we recommend that you provide additional clarification of answers to queries by entering your answers on the query sheet, in addition to the text mark-up.

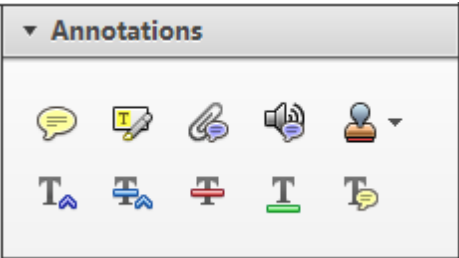
Query No.	Query	Remark
Q1	AUTHOR: Please confirm that given names (red) and surnames/family names (green) have been identified correctly.	Names are correct
Q2	AUTHOR: Please check that authors and their affiliations are correct.	correct
Q3	AUTHOR: Please define PRISMA.	
Q4	AUTHOR: Please define CBT-E.	
Q5	AUTHOR: If this is not a one-page article please supply the first and last pages for this article.	
Q6	AUTHOR: If this is not a one-page article please supply the first and last pages for this article.	
Q7	AUTHOR: If this is not a one-page article please supply the first and last pages for this article.	
Q8	AUTHOR: Please provide the city location of publisher for Reference 46.	
Q9	AUTHOR: If this reference has now been published online, please add relevant year/DOI information. If this reference has now been published in print, please add relevant volume/issue/page/year information.	
Q10	AUTHOR: Please define RCTs.	

Required software to e-Annotate PDFs: Adobe Acrobat Professional or Adobe Reader (version 7.0 or above). (Note that this document uses screenshots from Adobe Reader X)  
The latest version of Acrobat Reader can be downloaded for free at: <http://get.adobe.com/uk/reader/>

Once you have Acrobat Reader open on your computer, click on the [Comment](#) tab at the right of the toolbar:



This will open up a panel down the right side of the document. The majority of tools you will use for annotating your proof will be in the [Annotations](#) section, pictured opposite. We've picked out some of these tools below:



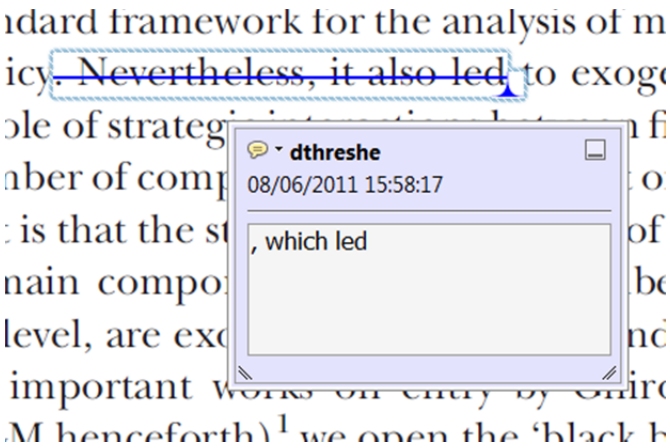
1. [Replace \(Ins\)](#) Tool – for replacing text.



Strikes a line through text and opens up a text box where replacement text can be entered.

How to use it

- Highlight a word or sentence.
- Click on the [Replace \(Ins\)](#) icon in the Annotations section.
- Type the replacement text into the blue box that appears.



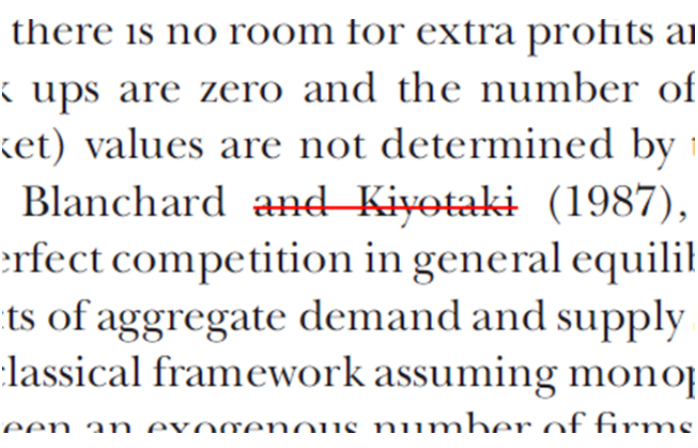
2. [Strikethrough \(Del\)](#) Tool – for deleting text.



Strikes a red line through text that is to be deleted.

How to use it

- Highlight a word or sentence.
- Click on the [Strikethrough \(Del\)](#) icon in the Annotations section.



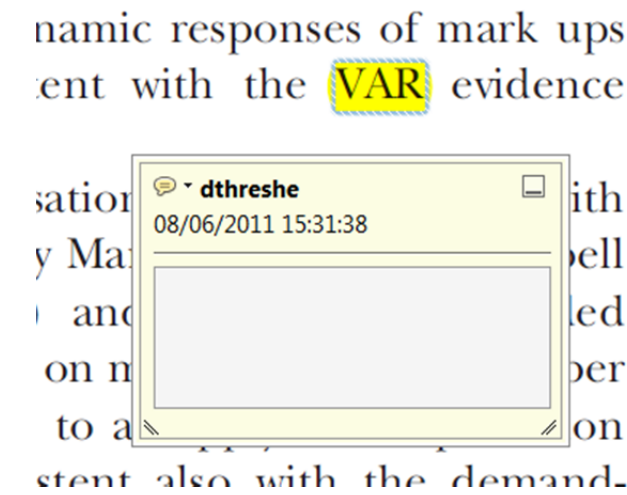
3. [Add note to text](#) Tool – for highlighting a section to be changed to bold or italic.



Highlights text in yellow and opens up a text box where comments can be entered.

How to use it

- Highlight the relevant section of text.
- Click on the [Add note to text](#) icon in the Annotations section.
- Type instruction on what should be changed regarding the text into the yellow box that appears.



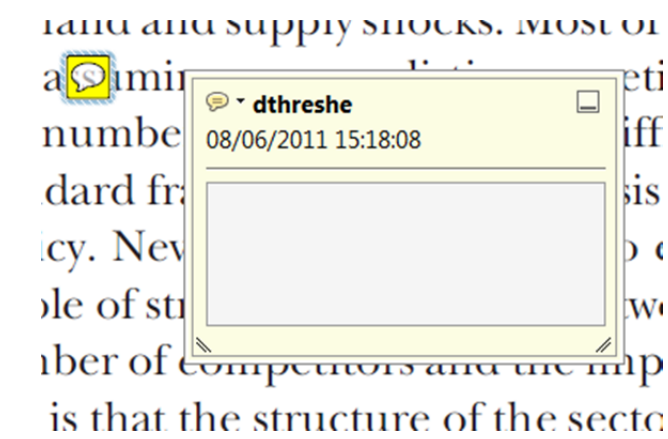
4. [Add sticky note](#) Tool – for making notes at specific points in the text.




Marks a point in the proof where a comment needs to be highlighted.

How to use it

- Click on the [Add sticky note](#) icon in the Annotations section.
- Click at the point in the proof where the comment should be inserted.
- Type the comment into the yellow box that appears.

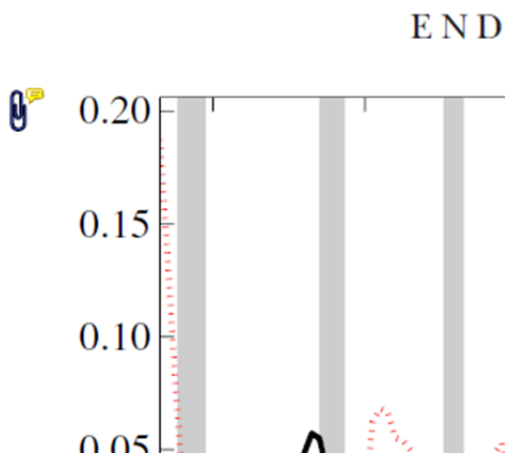


5. **Attach File** Tool – for inserting large amounts of text or replacement figures.


 Inserts an icon linking to the attached file in the appropriate place in the text.

How to use it

- Click on the **Attach File** icon in the Annotations section.
- Click on the proof to where you'd like the attached file to be linked.
- Select the file to be attached from your computer or network.
- Select the colour and type of icon that will appear in the proof. Click OK.



6. **Add stamp** Tool – for approving a proof if no corrections are required.

 Inserts a selected stamp onto an appropriate place in the proof.

How to use it

- Click on the **Add stamp** icon in the Annotations section.
- Select the stamp you want to use. (The **Approved** stamp is usually available directly in the menu that appears).
- Click on the proof where you'd like the stamp to appear. (Where a proof is to be approved as it is, this would normally be on the first page).

of the business cycle, starting with the  
on perfect competition, constant returns  
production. In this environment goods  
extra profits and the structure of market  
he number of firms in the individual firm  
etermined by the model. The New-Key  
otaki (1987), has introduced product  
general equilibrium models with nominal  
ed and supply shocks. Most of this literat

**APPROVED**

▼ Drawing Markups

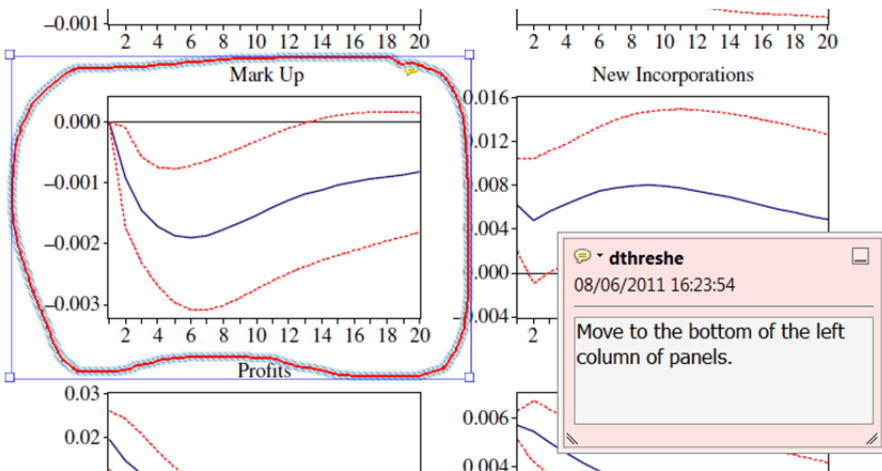


How to use it

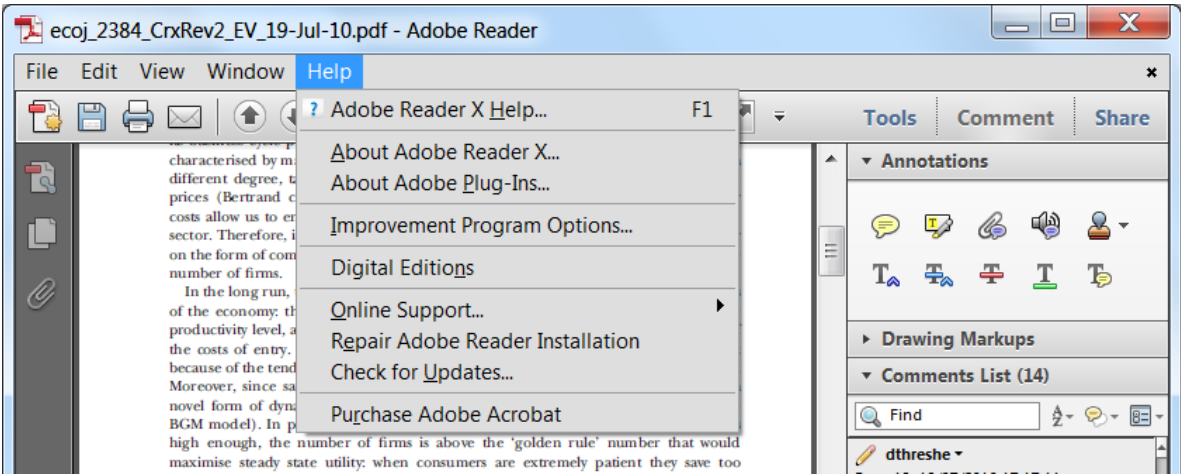
- Click on one of the shapes in the **Drawing Markups** section.
- Click on the proof at the relevant point and draw the selected shape with the cursor.
- To add a comment to the drawn shape, move the cursor over the shape until an arrowhead appears.
- Double click on the shape and type any text in the red box that appears.

7. **Drawing Markups** Tools – for drawing shapes, lines and freeform annotations on proofs and commenting on these marks.

Allows shapes, lines and freeform annotations to be drawn on proofs and for comment to be made on these marks..



For further information on how to annotate proofs, click on the **Help** menu to reveal a list of further options:



## WILEY AUTHOR DISCOUNT CLUB

We would like to show our appreciation to you, a highly valued contributor to Wiley's publications, by offering a **unique 25% discount** off the published price of any of our books\*.

All you need to do is apply for the **Wiley Author Discount Card** by completing the attached form and returning it to us at the following address:

The Database Group (Author Club)  
John Wiley & Sons Ltd  
The Atrium  
Southern Gate  
Chichester  
PO19 8SQ  
UK

Alternatively, you can **register online** at [www.wileyeurope.com/go/authordiscount](http://www.wileyeurope.com/go/authordiscount)  
Please pass on details of this offer to any co-authors or fellow contributors.

After registering you will receive your Wiley Author Discount Card with a special promotion code, which you will need to quote whenever you order books direct from us.

The quickest way to order your books from us is via our European website at:

**<http://www.wileyeurope.com>**

Key benefits to using the site and ordering online include:

- Real-time SECURE on-line ordering
- Easy catalogue browsing
- Dedicated Author resource centre
- Opportunity to sign up for subject-orientated e-mail alerts

Alternatively, you can order direct through Customer Services at:  
[cs-books@wiley.co.uk](mailto:cs-books@wiley.co.uk), or call +44 (0)1243 843294, fax +44 (0)1243 843303

So take advantage of this great offer and return your completed form today.

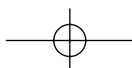
Yours sincerely,



Verity Leaver  
Group Marketing Manager  
[author@wiley.co.uk](mailto:author@wiley.co.uk)

### \*TERMS AND CONDITIONS

This offer is exclusive to Wiley Authors, Editors, Contributors and Editorial Board Members in acquiring books for their personal use. There must be no resale through any channel. The offer is subject to stock availability and cannot be applied retrospectively. This entitlement cannot be used in conjunction with any other special offer. Wiley reserves the right to amend the terms of the offer at any time.





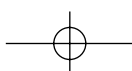
# REGISTRATION FORM

## For Wiley Author Club Discount Card

To enjoy your 25% discount, tell us your areas of interest and you will receive relevant catalogues or leaflets from which to select your books. Please indicate your specific subject areas below.

<b>Accounting</b> <input type="checkbox"/> <input type="checkbox"/> Public <input type="checkbox"/> <input type="checkbox"/> Corporate <input type="checkbox"/> <input type="checkbox"/>	<b>Architecture</b> <input type="checkbox"/> <input type="checkbox"/>
<b>Chemistry</b> <input type="checkbox"/> <input type="checkbox"/> Analytical <input type="checkbox"/> <input type="checkbox"/> Industrial/Safety <input type="checkbox"/> <input type="checkbox"/> Organic <input type="checkbox"/> <input type="checkbox"/> Inorganic <input type="checkbox"/> <input type="checkbox"/> Polymer <input type="checkbox"/> <input type="checkbox"/> Spectroscopy <input type="checkbox"/> <input type="checkbox"/>	<b>Business/Management</b> <input type="checkbox"/> <input type="checkbox"/> <b>Computer Science</b> <input type="checkbox"/> <input type="checkbox"/> Database/Data Warehouse <input type="checkbox"/> <input type="checkbox"/> Internet Business <input type="checkbox"/> <input type="checkbox"/> Networking <input type="checkbox"/> <input type="checkbox"/> Programming/Software <input type="checkbox"/> <input type="checkbox"/> Development <input type="checkbox"/> <input type="checkbox"/> Object Technology <input type="checkbox"/> <input type="checkbox"/>
<b>Encyclopedia/Reference</b> <input type="checkbox"/> <input type="checkbox"/> Business/Finance <input type="checkbox"/> <input type="checkbox"/> Life Sciences <input type="checkbox"/> <input type="checkbox"/> Medical Sciences <input type="checkbox"/> <input type="checkbox"/> Physical Sciences <input type="checkbox"/> <input type="checkbox"/> Technology <input type="checkbox"/> <input type="checkbox"/>	<b>Engineering</b> <input type="checkbox"/> <input type="checkbox"/> Civil <input type="checkbox"/> <input type="checkbox"/> Communications Technology <input type="checkbox"/> <input type="checkbox"/> Electronic <input type="checkbox"/> <input type="checkbox"/> Environmental <input type="checkbox"/> <input type="checkbox"/> Industrial <input type="checkbox"/> <input type="checkbox"/> Mechanical <input type="checkbox"/> <input type="checkbox"/>
<b>Earth &amp; Environmental Science</b> <input type="checkbox"/> <input type="checkbox"/>	<b>Finance/Investing</b> <input type="checkbox"/> <input type="checkbox"/> Economics <input type="checkbox"/> <input type="checkbox"/> Institutional <input type="checkbox"/> <input type="checkbox"/> Personal Finance <input type="checkbox"/> <input type="checkbox"/>
<b>Hospitality</b> <input type="checkbox"/> <input type="checkbox"/>	<b>Life Science</b> <input type="checkbox"/> <input type="checkbox"/>
<b>Genetics</b> <input type="checkbox"/> <input type="checkbox"/> Bioinformatics/ Computational Biology <input type="checkbox"/> <input type="checkbox"/> Proteomics <input type="checkbox"/> <input type="checkbox"/> Genomics <input type="checkbox"/> <input type="checkbox"/> Gene Mapping <input type="checkbox"/> <input type="checkbox"/> Clinical Genetics <input type="checkbox"/> <input type="checkbox"/>	<b>Landscape Architecture</b> <input type="checkbox"/> <input type="checkbox"/> <b>Mathematics</b> <input type="checkbox"/> <input type="checkbox"/> <b>Statistics</b> <input type="checkbox"/> <input type="checkbox"/>
<b>Medical Science</b> <input type="checkbox"/> <input type="checkbox"/> Cardiovascular <input type="checkbox"/> <input type="checkbox"/> Diabetes <input type="checkbox"/> <input type="checkbox"/> Endocrinology <input type="checkbox"/> <input type="checkbox"/> Imaging <input type="checkbox"/> <input type="checkbox"/> Obstetrics/Gynaecology <input type="checkbox"/> <input type="checkbox"/> Oncology <input type="checkbox"/> <input type="checkbox"/> Pharmacology <input type="checkbox"/> <input type="checkbox"/> Psychiatry <input type="checkbox"/> <input type="checkbox"/>	<b>Manufacturing</b> <input type="checkbox"/> <input type="checkbox"/> <b>Materials Science</b> <input type="checkbox"/> <input type="checkbox"/> <b>Psychology</b> <input type="checkbox"/> <input type="checkbox"/> Clinical <input type="checkbox"/> <input type="checkbox"/> Forensic <input type="checkbox"/> <input type="checkbox"/> Social & Personality <input type="checkbox"/> <input type="checkbox"/> Health & Sport <input type="checkbox"/> <input type="checkbox"/> Cognitive <input type="checkbox"/> <input type="checkbox"/> Organizational <input type="checkbox"/> <input type="checkbox"/> Developmental & Special Ed <input type="checkbox"/> <input type="checkbox"/> Child Welfare <input type="checkbox"/> <input type="checkbox"/> Self-Help <input type="checkbox"/> <input type="checkbox"/>
<b>Non-Profit</b> <input type="checkbox"/> <input type="checkbox"/>	<b>Physics/Physical Science</b> <input type="checkbox"/> <input type="checkbox"/>

Please complete the next page /





I confirm that I am (\*delete where not applicable):

a **Wiley** Book Author/Editor/Contributor\* of the following book(s):

ISBN:

ISBN:

a **Wiley** Journal Editor/Contributor/Editorial Board Member\* of the following journal(s):

SIGNATURE: ..... Date: .....

**PLEASE COMPLETE THE FOLLOWING DETAILS IN BLOCK CAPITALS:**

TITLE: (e.g. Mr, Mrs, Dr) ..... FULL NAME: .....

JOB TITLE (or Occupation): .....

DEPARTMENT: .....

COMPANY/INSTITUTION: .....

ADDRESS: .....

TOWN/CITY: .....

COUNTY/STATE: .....

COUNTRY: .....

POSTCODE/ZIP CODE: .....

DAYTIME TEL: .....

FAX: .....

E-MAIL: .....

**YOUR PERSONAL DATA**

We, John Wiley & Sons Ltd, will use the information you have provided to fulfil your request. In addition, we would like to:

1. Use your information to keep you informed by post of titles and offers of interest to you and available from us or other Wiley Group companies worldwide, and may supply your details to members of the Wiley Group for this purpose.  
[ ] Please tick the box if you do **NOT** wish to receive this information
2. Share your information with other carefully selected companies so that they may contact you by post with details of titles and offers that may be of interest to you.  
[ ] Please tick the box if you do **NOT** wish to receive this information.

**E-MAIL ALERTING SERVICE**

We also offer an alerting service to our author base via e-mail, with regular special offers and competitions. If you **DO** wish to receive these, please opt in by ticking the box [ ].

If, at any time, you wish to stop receiving information, please contact the Database Group ([databasegroup@wiley.co.uk](mailto:databasegroup@wiley.co.uk)) at John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, PO19 8SQ, UK.

**TERMS & CONDITIONS**

This offer is exclusive to Wiley Authors, Editors, Contributors and Editorial Board Members in acquiring books for their personal use. There should be no resale through any channel. The offer is subject to stock availability and may not be applied retrospectively. This entitlement cannot be used in conjunction with any other special offer. Wiley reserves the right to vary the terms of the offer at any time.

**PLEASE RETURN THIS FORM TO:**

Database Group (Author Club), John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, PO19 8SQ, UK [author@wiley.co.uk](mailto:author@wiley.co.uk)  
Fax: +44 (0)1243 770154

